



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 10  
1200 Sixth Avenue  
Seattle, Washington 98101


IN REPLY

REFER TO: OEA-095

January 26, 1999

MEMORANDUM

SUBJECT: Bunker Hill, CLP Metals Analysis, Data Validation  
Case: 26698  
SDG: MJAE40

FROM:  Laura Castrilli, Chemist  
Quality Assurance and Data Unit, OEA



TO: Mary Kay Voytilla, Regional Project Manager  
Office of Environmental Cleanup

CC: Bruce Woods, Region 10 CLP TPO  
Jim Stefanoff, CH2M Hill

The following is a validation of ICP-AES and mercury analyses of fourteen water samples from the Bunker Hill project. The analyses were performed following the USEPA Contract Laboratory Program Statement of Work for Inorganics Analysis Multi-media, Multi-Concentration, ILM04.0. Analyses were conducted by Sentinel Inc. of Huntsville, Alabama. This validation was conducted for the following samples:

**Total (unfiltered) samples:**

MJAE40 MJAE41 MJAE42 MJAE43 MJAE44 MJAE45 MJAE46

**Dissolved (filtered) samples:**

MJAE47 MJAE48 MJAE49 MJAE50 MJAE51 MJAE52 MJAE53

**Data Qualifications**

The following comments refer to the Sentinel Laboratory's performance in meeting quality control specifications outlined in the *CLP Statement of Work (CLP-SOW) for Inorganic Analysis, rev. ILM04.0*. The comments presented herein are based on the information provided for the review.

**1.0 Timeliness - Acceptable**

The technical (40 CFR part 136) holding time from the date of collection for mercury in water is 28 days. The holding time for the remaining metals in water is 180 days. The samples were collected

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on 12/01/98. Mercury analyses were completed on 12/23/98. ICP-AES analyses were completed on 01/03/99.

## 2.0 Sample Preparation - Acceptable

The samples were prepared for mercury and ICP-AES analyses on 12/21/98.

## 3.0 Calibrations/Calibration Verifications -

The samples were analyzed for mercury by CVAAS on 12/23/98. Initial calibration included one blank and five standards. The curve was linear with a correlation coefficient greater than 0.995.

The samples were analyzed by ICP-AES on 12/22/98 (main analyses), 12/28/98 (cadmium and selenium analyses), 12/28/98 (ten fold dilutions for sodium in two samples, 10 and 100 fold dilutions for iron, manganese, and/or zinc in a number of samples), and 01/03/99 (one thousand fold dilutions for zinc in samples MJAE44 and MJAE51. The instrument was standardized according to the analytical method each day of analysis using one blank and a single calibration standard for each element.

All ICP-AES and CVAAS (mercury) calibrations were performed as required and met the acceptance criteria; therefore, no qualification was made on this basis.

Continuing calibration verifications (CCVs) are required before and after sample analysis and after every 10 samples during analysis. Mercury recoveries must be within 80-120%. Other metal recoveries must be within 90-110%. The frequency of analysis of CCVs was met. All ICP-AES and CVAAS (mercury) CCVs (initial and continuing) bracketing reported sample results met the recovery criteria with the exception of the following:

- ◆ CCV performed on 12/22/98 at 6:47: iron (121.4%), manganese (112.4%), and zinc (175%). Some of the samples had very high levels of iron, manganese, and zinc. The associated continuing calibration blank showed evidence of carry over which may have contributed to the high recovery for the CCV. Associated iron, manganese, and zinc results (samples MJAE43, MJAE49, and MJAE50) that were reported from this analysis were qualified 'J', estimated (potential high bias to the iron, manganese, and zinc results).
- ◆ CCV performed on 12/28/98 at 20:09: zinc (112%). Again, the associated continuing calibration blank showed evidence of carry over which may have contributed to the high recovery for the CCV. Associated zinc results (samples MJAE41, MJAE45, MJAE46, MJAE47, MJAE48, and MJAE52) that were reported from this analysis were qualified 'J', estimated (potential high bias to zinc results).

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#### 4.0 Laboratory Control Samples - Acceptable

Laboratory Control samples are digested and analyzed along with the samples to verify the efficiency of laboratory procedures. All recoveries associated with reported sample results met the acceptance criteria for control samples.

#### 5.0 Blanks -

Procedural blanks were prepared with the samples to show potential contamination from the digestion or analytical procedure. If an analyte was found in the associated blank, the sample results were qualified if the analyte concentration was less than five times the analytical value in the blank.

Calcium, iron, and zinc were detected in the preparation blank. Aluminum, arsenic, calcium, cadmium, iron, magnesium, manganese, selenium, and zinc were detected in one or more ICP-AES continuing calibration blanks. Based on blank contamination, associated sample results were qualified as follows:

- ◆ aluminum in sample MJAE43 was qualified 'U'
- ◆ cadmium in sample MJAE46 was qualified 'U'
- ◆ selenium in samples MJAE42, MJAE43, MJAE49, and MJAE50 was qualified 'U'

All other sample results were greater than five times the associated blank levels (or were already undetected) and were not qualified based on blank contamination.

#### 6.0 ICP-AES Interference Check Sample -

The interference check sample (ICS) is analyzed by ICP-AES to verify interelement and background correction factors. Analysis is required at the beginning and end of each sample analysis run and recoveries must be between 80% and 120%. All ICS recoveries associated with reported sample results were within the recovery criterion with the exception of the recovery for copper, manganese and zinc in the ICS-A analyses on 12/22/98 and zinc in the ICS-A analyses on 12/28/98. Copper, manganese, and zinc results in the associated samples were not qualified due to the following reasons: 1) the recovery for copper, manganese, and zinc in the ICS-AB analyses were acceptable, 2) the associated/reported results in the samples were closer to or higher than the levels in the ICS-AB sample, and/or 3) the samples did not have corresponding interferent levels of interfering analytes.

Some of the samples required multiple dilution runs to keep report zinc, iron, manganese, and sodium results within the instrumental linear range. The raw data for all analytes were compared using the available dilutions to see if 1) zinc, iron, sodium, and/or manganese levels in the undiluted samples were high enough that interelement corrections may not be sufficient for the analytes that were reported

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from the undiluted analyses or 2) a pattern of suppression or enhancement was evident.

From this comparative study, the following results were qualified due to suspected interference:

- ◆ Aluminum, antimony, arsenic, calcium, cadmium, cobalt, copper, magnesium, nickel, silver, and thallium were qualified 'J', estimated (possible low bias) in samples MJAE44 and MJAE51
- ◆ Sodium was qualified 'J', estimated (pattern of enhancement/possible high bias) in samples MJAE44 and MJAE51
- ◆ Manganese was qualified 'J', estimated (unknown bias as the undiluted analyses were within the linear range, the ten fold dilutions were outside the linear range and the lab ended up reporting the results from the one hundred fold dilutions) in samples MJAE44 and MJAE51.
- ◆ Sodium was qualified 'J', estimated (pattern of enhancement/possible high bias) in samples MJAE45 and MJAE52.

#### 7.0 Duplicate Analysis - Acceptable

Duplicate analyses were done on dissolved sample MJAE50 and total sample MJAE43. Water duplicate results were within the  $\pm 20\%$  Relative Percent Difference (RPD) or  $\pm$ CRDL criteria for water results < 5 times the CRDL criteria. No qualification was made on this basis.

#### 8.0 Field Duplicate Analysis - Not Applicable

Field duplicate analysis for samples in this SDG was not indicated in the field collection documentation.

#### 9.0 Matrix Spike Analysis -

Matrix spike sample analyses are done to provide information about the effect of the sample matrix on digestion and measurement methods. Matrix spike recovery must be within the limits of 75 - 125%.

Matrix spike analyses were done on dissolved sample MJAE50 and total sample MJAE43. All matrix spike recoveries were within the required QC limits; with the exception of antimony (69% for total) and selenium (127% for dissolved, 12% for total). Antimony results in total samples (MJAE40 through MJAE46) were qualified 'J', estimated (suspected low bias). Detected selenium results in dissolved samples (MJAE47 through MJAE53) were qualified 'J', estimated (suspected high bias). For total samples (MJAE40 through MJAE46) detected selenium results were qualified 'J', estimated (suspected low bias), while undetected selenium results were qualified 'R', due to the extremely low recovery.

#### 10.0 Graphite Furnace Atomic Absorption Spec (GFAAS) QC - Not Applicable - GFAAS was not used for the analysis of these samples.

### 11.0 ICP-AES Serial Dilution -

Dissolved sample MJAE50 and total sample MJAE43 were analyzed by ICP-AES serial dilution to check for potential interferences. All analytes which exceeded the minimum concentration criterion (50 times the IDL) agreed within the 10%D criteria; with the exception of iron (19.3% for dissolved), lead (11.7% for dissolved), and potassium (11.5% for total). Dissolved iron and lead results (samples MJAE47 through MJAE53) were qualified 'J', estimated based on serial dilution results. Total potassium results (samples MJAE40 through MJAE46) were qualified 'J', estimated based on serial dilution results.

### 12.0 Detection Limits - Acceptable

Sample results which fall below the instrument detection limit (IDL) are assigned the value of the instrument detection limit and the 'U' qualifier is attached. Contract Required Detection Limit (CRDL) standards are required to demonstrate a linear calibration curve near the CRDL. CRDL standards were run at the required frequency.

### 13.0 Overall Assessment of the Data

This validation of the data is based on the criteria outlined in the *National Functional Guidelines for Inorganic Data Review (02/94)*. Approximately 24% of the data was qualified based on blank contamination, continuing calibration verification, interference, matrix spike recovery or serial dilution results. The data as qualified is acceptable for all purposes.

Below are the definitions for the National Functional Guidelines for Inorganic Data Review (02/94) qualifiers used when validating/qualifying data from Inorganic analysis.

#### DATA QUALIFIERS

- U - The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.
- J - The associated value is an estimated quantity.
- R - The data are unusable. (Note: Analyte may or may not be present.)
- UJ - The material was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.

INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

MJAE40

Lab Name: SENTINEL, INC.

Contract: 68-D6-0001

Lab Code: SENTIN

Case No.: 26698

SAS No.:

SDG No.: MJAE40

Matrix (soil/water): WATER

Lab Sample ID: 17020S

Level (low/med): LOW

Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	2840	-		P
7440-36-0	Antimony	4.0	U	#J	P
7440-38-2	Arsenic	54.9			P
7440-39-3	Barium	29.8	B		P
7440-41-7	Beryllium	1.1	B		P
7440-43-9	Cadmium	211			P
7440-70-2	Calcium	27200			P
7440-47-3	Chromium	2.7	B		P
7440-48-4	Cobalt	73.7			P
7440-50-8	Copper	148			P
7439-89-6	Iron	78000			P
7439-92-1	Lead	416		B	P
7439-95-4	Magnesium	47900			P
7439-96-5	Manganese	31100			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	67.8			P
7440-09-7	Potassium	1210	B	#J	P
7782-49-2	Selenium	1.9	U	NR	P
7440-22-4	Silver	12.3			P
7440-23-5	Sodium	4110	B		P
7440-28-0	Thallium	4.1	B		P
7440-62-2	Vanadium	2.9	U		P
7440-66-6	Zinc	96500			NR
	Cyanide				NR

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DR 12/25/99

Color Before: COLORLESS

Clarity Before: CLEAR

Texture:

Color After: COLORLESS

Clarity After: CLEAR

Artifacts:

Comments:

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## INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

MJAE41

Lab Name: SENTINEL, INC.

Contract: 68-D6-0001

Lab Code: SENTIN

Case No.: 26698

SAS No.:

SDG No.: MJAE40

Matrix (soil/water): WATER

Lab Sample ID: 17021S

Level (low/med): LOW

Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	5630			P
7440-36-0	Antimony	4.2	B	NS	P
7440-38-2	Arsenic	158			P
7440-39-3	Barium	11.3	B		P
7440-41-7	Beryllium	2.4	B		P
7440-43-9	Cadmium	409			P
7440-70-2	Calcium	29800			P
7440-47-3	Chromium	3.2	B		P
7440-48-4	Cobalt	131			P
7440-50-8	Copper	290			P
7439-89-6	Iron	188000			P
7439-92-1	Lead	384		H	P
7439-95-4	Magnesium	51400			P
7439-96-5	Manganese	45100			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	111			P
7440-09-7	Potassium	1070	B	NS	P
7782-49-2	Selenium	1.9	U	NR	P
7440-22-4	Silver	18.8			P
7440-23-5	Sodium	8660			P
7440-28-0	Thallium	4.0	B		P
7440-62-2	Vanadium	2.9	U		P
7440-66-6	Zinc			J	NR
	Cyanide	187840			NR

Color Before: COLORLESS

Clarity Before: CLEAR

Texture:

Color After: COLORLESS

Clarity After: CLEAR

Artifacts:

Comments:

EPA SAMPLE NO.

## INORGANIC ANALYSIS DATA SHEET

MJAE42

Lab Name: SENTINEL, INC.

Contract: 68-D6-0001

Lab Code: SENTIN

Case No.: 26698

SAS No.:

SDG No.: MJAE40

Matrix (soil/water): WATER

Lab Sample ID: 17022S

Level (low/med): LOW

Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	144	B		P
7440-36-0	Antimony	4.0	U	NJ	P
7440-38-2	Arsenic	2.0	U		P
7440-39-3	Barium	63.3	B		P
7440-41-7	Beryllium	0.60	U		P
7440-43-9	Cadmium	20.3			P
7440-70-2	Calcium	20700			P
7440-47-3	Chromium	0.90	U		P
7440-48-4	Cobalt	18.9	B		P
7440-50-8	Copper	13.9	B		P
7439-89-6	Iron	2550			NR P
7439-92-1	Lead	585		#	P
7439-95-4	Magnesium	50600			P
7439-96-5	Manganese	15400			NR P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	23.9	B		P
7440-09-7	Potassium	1180	B	#J	P
7782-49-2	Selenium	2.8	B	NJ	P
7440-22-4	Silver	4.3	B		P
7440-23-5	Sodium	1250	B		P
7440-28-0	Thallium	3.6	U		P
7440-62-2	Vanadium	2.9	U		P
7440-66-6	Zinc				NR P
	Cyanide	4802			NR

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12/6/99

Color Before: COLORLESS

Clarity Before: CLEAR

Texture:

Color After: COLORLESS

Clarity After: CLEAR

Artifacts:

Comments:



INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

MJAE43

Lab Name: SENTINEL, INC.

Contract: 68-D6-0001

Lab Code: SENTIN

Case No.: 26698

SAS No.:

SDG No.: MJAE40

Matrix (soil/water): WATER

Lab Sample ID: 17023S

Level (low/med): LOW

Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	145	B	U	P
7440-36-0	Antimony	4.0	U	#J	P
7440-38-2	Arsenic	2.0	U		P
7440-39-3	Barium	64.1	B		P
7440-41-7	Beryllium	0.60	U		P
7440-43-9	Cadmium	19.5			P
7440-70-2	Calcium	20300			P
7440-47-3	Chromium	0.90	U		P
7440-48-4	Cobalt	19.1	B		P
7440-50-8	Copper	13.4	B		P
7439-89-6	Iron	2940		J	NR P
7439-92-1	Lead	694		E	P
7439-95-4	Magnesium	50400			P
7439-96-5	Manganese	15400		J	NR P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	22.7	B		P
7440-09-7	Potassium	1210	B	#J	P
7782-49-2	Selenium	2.8	B	NR JS	P
7440-22-4	Silver	4.2	B		P
7440-23-5	Sodium	1330	B		P
7440-28-0	Thallium	3.6	U		P
7440-62-2	Vanadium	2.9	U		P
7440-66-6	Zinc	4550		J	NR P
	Cyanide				NR

Q  
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1/18/99

Color Before: COLORLESS

Clarity Before: CLEAR

Texture:

Color After: COLORLESS

Clarity After: CLEAR

Artifacts:

Comments:

EPA SAMPLE NO.

## INORGANIC ANALYSIS DATA SHEET

MJAE44

Lab Name: SENTINEL, INC.

Contract: 68-D6-0001

Lab Code: SENTIN

Case No.: 26698

SAS No.:

SDG No.: MJAE40

Matrix (soil/water): WATER

Lab Sample ID: 17024S

Level (low/med): LOW

Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	225000		J	P
7440-36-0	Antimony	226		#J	P
7440-38-2	Arsenic	8470		J	P
7440-39-3	Barium	13.8	B		P
7440-41-7	Beryllium	36.0			P
7440-43-9	Cadmium	10400		J	P
7440-70-2	Calcium	138000		J	P
7440-47-3	Chromium	41.3			P
7440-48-4	Cobalt	3450		J	P
7440-50-8	Copper	12100		J	P
7439-89-6	Iron	14000000		J	P
7439-92-1	Lead	146		#	P
7439-95-4	Magnesium	344000		J	P
7439-96-5	Manganese	2200000		J	P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	2610		J	P
7440-09-7	Potassium	162	B	#J	P
7782-49-2	Selenium	1.9	U	NR	P
7440-22-4	Silver	1.1	U	J	P
7440-23-5	Sodium	691000		J	P
7440-28-0	Thallium	117		J	P
7440-62-2	Vanadium	2.9	U		P
7440-66-6	Zinc	20000000			P
	Cyanide				NR

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Color Before: COLORLESS

Clarity Before: CLEAR

Texture:

Color After: COLORLESS

Clarity After: CLEAR

Artifacts:

Comments:

INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

MJAE45

Lab Name: SENTINEL, INC.

Contract: 68-D6-0001

Lab Code: SENTIN

Case No.: 26698

SAS No.:

SDG No.: MJAE40

Matrix (soil/water): WATER

Lab Sample ID: 17025S

Level (low/med): LOW

Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	19500	-		P
7440-36-0	Antimony	22.5	B	<del>NR</del> J	P
7440-38-2	Arsenic	350			P
7440-39-3	Barium	8.0	B		P
7440-41-7	Beryllium	8.2			P
7440-43-9	Cadmium	1820			P
7440-70-2	Calcium	55200			P
7440-47-3	Chromium	28.1			P
7440-48-4	Cobalt	395			P
7440-50-8	Copper	1090			P
7439-89-6	Iron	1170000			P
7439-92-1	Lead	1090		E	P
7439-95-4	Magnesium	130000			P
7439-96-5	Manganese	180000			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	346			P
7440-09-7	Potassium	974	B	<del>E</del> J	P
7782-49-2	Selenium	1.9	<del>U</del>	<del>NR</del> R	P
7440-22-4	Silver	67.6			P
7440-23-5	Sodium	76600		J	P
7440-28-0	Thallium	59.4			P
7440-62-2	Vanadium	2.9	U		P
7440-66-6	Zinc	1030000		J	NR
	Cyanide				NR

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1/20/99

Color Before: COLORLESS

Clarity Before: CLEAR

Texture:

Color After: COLORLESS

Clarity After: CLEAR

Artifacts:

Comments:

EPA SAMPLE NO.

## INORGANIC ANALYSIS DATA SHEET

MJAE46

Lab Name: SENTINEL, INC.

Contract: 68-D6-0001

Lab Code: SENTIN

Case No.: 26698

SAS No.:

SDG No.: MJAE40

Matrix (soil/water): WATER

Lab Sample ID: 17026S

Level (low/med): LOW

Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	561	-		P
7440-36-0	Antimony	4.0	U	NJ	P
7440-38-2	Arsenic	23.6			P
7440-39-3	Barium	5.1	B		P
7440-41-7	Beryllium	0.60	U		P
7440-43-9	Cadmium	1.7	B	u	P
7440-70-2	Calcium	3790	B		P
7440-47-3	Chromium	0.90	U		P
7440-48-4	Cobalt	7.8	B		P
7440-50-8	Copper	12.8	B		P
7439-89-6	Iron	15100			P
7439-92-1	Lead	28.3		E	P
7439-95-4	Magnesium	1650	B		P
7439-96-5	Manganese	1790			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	3.9	B		P
7440-09-7	Potassium	794	B	NJ	P
7782-49-2	Selenium	1.9	U	NR	P
7440-22-4	Silver	1.1	U		P
7440-23-5	Sodium	693	B		P
7440-28-0	Thallium	3.6	U		P
7440-62-2	Vanadium	2.9	U		P
7440-66-6	Zinc	550		J	NR
	Cyanide				NR

Color Before: COLORLESS

Clarity Before: CLEAR

Texture:

Color After: COLORLESS

Clarity After: CLEAR

Artifacts:

Comments:

EPA SAMPLE NO.

## INORGANIC ANALYSIS DATA SHEET

MJAE47

Lab Name: SENTINEL, INC.

Contract: 68-D6-0001

Lab Code: SENTIN

Case No.: 26698

SAS No.:

SDG No.: MJAE40

Matrix (soil/water): WATER

Lab Sample ID: 17027S

Level (low/med): LOW

Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	3020	-		P
7440-36-0	Antimony	4.0	U	<del>N</del>	P
7440-38-2	Arsenic	19.7			P
7440-39-3	Barium	33.2	B		P
7440-41-7	Beryllium	1.1	B		P
7440-43-9	Cadmium	217			P
7440-70-2	Calcium	27800			P
7440-47-3	Chromium	1.6	B		P
7440-48-4	Cobalt	72.7			P
7440-50-8	Copper	172			P
7439-89-6	Iron	70700		J	P
7439-92-1	Lead	397		EJ	P
7439-95-4	Magnesium	48800			P
7439-96-5	Manganese	31800			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	67.7			P
7440-09-7	Potassium	1330	B	<del>E</del>	P
7782-49-2	Selenium	1.9	U	<del>N</del>	P
7440-22-4	Silver	10.1			P
7440-23-5	Sodium	4570	B		P
7440-28-0	Thallium	3.6	U		P
7440-62-2	Vanadium	2.9	U		P
7440-66-6	Zinc	98900		J	NR
	Cyanide				NR

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12/25/99

Color Before: COLORLESS

Clarity Before: CLEAR

Texture:

Color After: COLORLESS

Clarity After: CLEAR

Artifacts:

Comments:

EPA SAMPLE NO.

## INORGANIC ANALYSIS DATA SHEET

MJAE48

Lab Name: SENTINEL, INC.

Contract: 68-D6-0001

Lab Code: SENTIN

Case No.: 26698

SAS No.:

SDG No.: MJAE40

Matrix (soil/water): WATER

Lab Sample ID: 17028S

Level (low/med): LOW

Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	5750	-		P
7440-36-0	Antimony	4.0	U	<del>N</del>	P
7440-38-2	Arsenic	97.4			P
7440-39-3	Barium	12.0	B		P
7440-41-7	Beryllium	2.3	B		P
7440-43-9	Cadmium	412			P
7440-70-2	Calcium	29500			P
7440-47-3	Chromium	2.3	B		P
7440-48-4	Cobalt	128			P
7440-50-8	Copper	294			P
7439-89-6	Iron	167000		J	P
7439-92-1	Lead	355		<del>EJ</del>	P
7439-95-4	Magnesium	51500			P
7439-96-5	Manganese	44800			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	108			P
7440-09-7	Potassium	1090	B	<del>E</del>	P
7782-49-2	Selenium	1.9	U	<del>N</del>	P
7440-22-4	Silver	18.0			P
7440-23-5	Sodium	8650			P
7440-28-0	Thallium	3.6	U		P
7440-62-2	Vanadium	2.9	U		P
7440-66-6	Zinc	187000		J	NR
	Cyanide				NR

PA 1-5-99

12/02/99

Color Before: COLORLESS

Clarity Before: CLEAR

Texture:

Color After: COLORLESS

Clarity After: CLEAR

Artifacts:

Comments:

EPA SAMPLE NO.

## INORGANIC ANALYSIS DATA SHEET

MJAE49

Lab Name: SENTINEL, INC.

Contract: 68-D6-0001

Lab Code: SENTIN

Case No.: 26698

SAS No.:

SDG No.: MJAE40

Matrix (soil/water): WATER

Lab Sample ID: 17029S

Level (low/med): LOW

Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	20.4	U		P
7440-36-0	Antimony	4.0	U	<del>NR</del>	P
7440-38-2	Arsenic	2.0	U		P
7440-39-3	Barium	64.1	B		P
7440-41-7	Beryllium	0.60	U		P
7440-43-9	Cadmium	19.7			P
7440-70-2	Calcium	21100			P
7440-47-3	Chromium	1.0	B		P
7440-48-4	Cobalt	20.3	B		P
7440-50-8	Copper	3.8	B		P
7439-89-6	Iron	1440		J	<del>NR</del> P
7439-92-1	Lead	139		E-J	P
7439-95-4	Magnesium	51300			P
7439-96-5	Manganese	15600		J	<del>NR</del> P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	23.5	B		P
7440-09-7	Potassium	1220	B	<del>E</del>	P
7782-49-2	Selenium	1.9	<del>B</del>	<del>NR</del>	P
7440-22-4	Silver	4.9	B		P
7440-23-5	Sodium	1620	B		P
7440-28-0	Thallium	3.6	U		P
7440-62-2	Vanadium	2.9	U		P
7440-66-6	Zinc	4720		J	<del>NR</del> P
	Cyanide				NR

1-5-99

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Color Before: COLORLESS

Clarity Before: CLEAR

Texture:

Color After: COLORLESS

Clarity After: CLEAR

Artifacts:

Comments:

EPA SAMPLE NO.

## INORGANIC ANALYSIS DATA SHEET

MJAE50

Lab Name: SENTINEL, INC.

Contract: 68-D6-0001

Lab Code: SENTIN

Case No.: 26698

SAS No.:

SDG No.: MJAE40

Matrix (soil/water): WATER

Lab Sample ID: 17030S

Level (low/med): LOW

Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	71.2	B		P
7440-36-0	Antimony	4.0	U	N	P
7440-38-2	Arsenic	2.0	U		P
7440-39-3	Barium	62.7	B		P
7440-41-7	Beryllium	0.60	U		P
7440-43-9	Cadmium	19.0			P
7440-70-2	Calcium	20800			P
7440-47-3	Chromium	0.90	U		P
7440-48-4	Cobalt	19.2	B		P
7440-50-8	Copper	5.2	B		P
7439-89-6	Iron	1250		J	NR P
7439-92-1	Lead	114		EJ	P
7439-95-4	Magnesium	50200			P
7439-96-5	Manganese	15400		J	NR P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	22.3	B		P
7440-09-7	Potassium	1200	B	E	P
7782-49-2	Selenium	2.0	B	NCS	P
7440-22-4	Silver	4.6	B		P
7440-23-5	Sodium	1740	B		P
7440-28-0	Thallium	3.6	U		P
7440-62-2	Vanadium	2.9	U		P
7440-66-6	Zinc	4620		J	NR P
	Cyanide				NR

1-5-99

11/01/99

Color Before: COLORLESS

Clarity Before: CLEAR

Texture:

Color After: COLORLESS

Clarity After: CLEAR

Artifacts:

Comments:



INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

MJAE51

Lab Name: SENTINEL, INC.

Contract: 68-D6-0001

Lab Code: SENTIN

Case No.: 26698

SAS No.:

SDG No.: MJAE40

Matrix (soil/water): WATER

Lab Sample ID: 17031S

Level (low/med): LOW

Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	223000		J	P
7440-36-0	Antimony	232		#J	P
7440-38-2	Arsenic	8480		J	P
7440-39-3	Barium	14.0	B		P
7440-41-7	Beryllium	36.5			P
7440-43-9	Cadmium	10600		J	P
7440-70-2	Calcium	140000		J	P
7440-47-3	Chromium	41.7			P
7440-48-4	Cobalt	3530		J	P
7440-50-8	Copper	12000		J	P
7439-89-6	Iron	13500000		J	P
7439-92-1	Lead	137		#J	P
7439-95-4	Magnesium	358000		J	P
7439-96-5	Manganese	2130000		J	P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	2680		J	P
7440-09-7	Potassium	151	B	#J	P
7782-49-2	Selenium	1.9	U	#J	P
7440-22-4	Silver	1.1	U	J	P
7440-23-5	Sodium	668000		J	P
7440-28-0	Thallium	127		J	P
7440-62-2	Vanadium	2.9	U		P
7440-66-6	Zinc	19600000			P
	Cyanide				NR

12/16/98

Color Before: COLORLESS

Clarity Before: CLEAR

Texture:

Color After: COLORLESS

Clarity After: CLEAR

Artifacts:

Comments:

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EPA SAMPLE NO.

## INORGANIC ANALYSIS DATA SHEET

MJAE52

Lab Name: SENTINEL, INC.

Contract: 68-D6-0001

Lab Code: SENTIN

Case No.: 26698

SAS No.:

SDG No.: MJAE40

Matrix (soil/water): WATER

Lab Sample ID: 17032S

Level (low/med): LOW

Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	18900	-		P
7440-36-0	Antimony	20.9	B	<del>N</del>	P
7440-38-2	Arsenic	330			P
7440-39-3	Barium	8.5	B		P
7440-41-7	Beryllium	7.7			P
7440-43-9	Cadmium	1760			P
7440-70-2	Calcium	53700			P
7440-47-3	Chromium	26.3			P
7440-48-4	Cobalt	380			P
7440-50-8	Copper	1060			P
7439-89-6	Iron	1100000		J	P
7439-92-1	Lead	1040		<del>EJ</del>	P
7439-95-4	Magnesium	127000			P
7439-96-5	Manganese	170000			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	331			P
7440-09-7	Potassium	936	B	<del>E</del>	P
7782-49-2	Selenium	1.9	U	<del>N</del>	P
7440-22-4	Silver	63.6			P
7440-23-5	Sodium	71500			P
7440-28-0	Thallium	60.0			P
7440-62-2	Vanadium	2.9	U		P
7440-66-6	Zinc	455000		J	<del>NR</del>
	Cyanide				NR

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OK 01/25/99

Color Before: COLORLESS

Clarity Before: CLEAR

Texture:

Color After: COLORLESS

Clarity After: CLEAR

Artifacts:

Comments:

## INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

MJAE53

Lab Name: SENTINEL, INC.

Contract: 68-D6-0001

Lab Code: SENTIN

Case No.: 26698

SAS No.:

SDG No.: MJAE40

Matrix (soil/water): WATER

Lab Sample ID: 17033S

Level (low/med): LOW

Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	491	-		P
7440-36-0	Antimony	4.0	U	<del>N</del>	P
7440-38-2	Arsenic	12.0			P
7440-39-3	Barium	4.6	B		P
7440-41-7	Beryllium	0.60	U		P
7440-43-9	Cadmium	2.7	B		P
7440-70-2	Calcium	4080	B		P
7440-47-3	Chromium	0.90	U		P
7440-48-4	Cobalt	8.4	B		P
7440-50-8	Copper	4.8	B		P
7439-89-6	Iron	14600		J	<del>NR</del> P
7439-92-1	Lead	24.6		<del>B</del> J	P
7439-95-4	Magnesium	1820	B		P
7439-96-5	Manganese	2000			<del>NR</del> P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	4.9	B		P
7440-09-7	Potassium	760	B	<del>B</del>	P
7782-49-2	Selenium	1.9	U	<del>N</del>	P
7440-22-4	Silver	1.1	U		P
7440-23-5	Sodium	756	B		P
7440-28-0	Thallium	3.6	U		P
7440-62-2	Vanadium	2.9	U		P
7440-66-6	Zinc				<del>NR</del> P
	Cyanide	1670			NR

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1-5-99

APC 01/05/99

Color Before: COLORLESS

Clarity Before: CLEAR

Texture:

Color After: COLORLESS

Clarity After: CLEAR

Artifacts:

Comments: